

## JOINT AIR-TO-SURFACE STANDOFF MISSILE (JASSM)



### Air Force ACAT ID Program

Total Number of Systems:	2,400
Total Program Cost (TY\$):	\$1982.4M
Average Unit Cost (TY\$):	\$487K
Full-rate production:	4QFY02

### Prime Contractor

Lockheed Martin Integrated Systems

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Joint Air-to-Surface Standoff Missile (JASSM) is a ***precision engagement*** weapon that integrates the standoff delivery accuracy and effectiveness required to kill critical enemy targets with the necessary technologies to ensure high missile survivability. This precision engagement capability will enable joint U.S. and combined allied forces to conduct sustained and synchronized operations from dispersed locations to ensure ***dominant maneuver***.

The JASSM Missile System is an Acquisition Category 1D effort to develop a survivable precision cruise missile capable of launch from outside area defenses to kill hard, medium-hardened, and soft/soft-distributed targets. The weapon is required to attack both fixed and relocatable targets. The threshold integration aircraft are the F-16 (Block 50) and B-52H. Although carrier operability remains a key performance parameter, the Navy F/A-18 E/F has been redesignated as an objective platform. The Navy will determine the schedule for integration onto the F/A-18 E/F.

The Key Performance Parameters for the system are: Missile Mission Effectiveness (expressed as a mission level measure of overall ability to kill a defined target set), Missile Range, and Carrier Operability. The program office developmental concept subordinates all other operational requirements to potential contractor performance/cost tradeoffs to achieve the best value weapon for the service users. These cost-performance trades are to be defined through continued and open interaction between the service users, the program office, the OTAs, and the prime contractor. The program requires the contractor to deliver a fully warranted, all-up round for threshold price of less than \$700 thousand each (BY95\$). The current average unit procurement price is \$317 thousand (FY95), well below the objective price of \$400 thousand each (FY95) and a 15-year bumper-to-bumper warranty.

## **BACKGROUND INFORMATION**

Initially, the program entertained proposals from seven contractors. The build-up to the release of the request for industry proposal was a period of intense interaction between the contractors and the government team. This open interaction and continued aggressive competition in performance and cost assessment are the keystones of the program office strategy. The final competition phase was between two participants in a Program Definition-Risk Reduction (PDRR) phase. Lockheed Martin and McDonnell Douglas (a wholly owned subsidiary of Boeing) were the prime competing contractors for the PDRR phase. Lockheed Martin was down-selected as the winning contractor in April 1998. The program is currently in EMD. A combined developmental/operational test phase will begin in 3QFY00.

During PDRR, Congress directed the Air Force and Navy to perform an updated Analysis of Alternatives (AOA) to determine the relative value of JASSM versus a proposed variant of the Navy Stand-Off Land Attack Missile-Expanded Response Plus (SLAM-ER+). The results of the AOA substantiated the continued requirement for JASSM.

A November 9, 1998, Milestone II Acquisition Decision Memorandum (ADM) approved JASSM entry into EMD and LRIP entrance criteria. Additionally, the ADM approved adding \$97.5 million to fund a 6-month EMD schedule extension to reduce overall program risk. As a result, LRIP moved to January, Milestone III moves to July 2002, and B-52H RAA moved to 4QFY02.

In September 1999, SAF/AQ directed the JASSM program office to restructure the program master schedule and delay LRIP go-ahead from January 2001 to November 2001. This decision was driven by several technical delays in development. These delays were the result of several factors:

- Teledyne engine development was progressing slower due to design changes to the engine main bearing, digital fuel control, and delays in the improved engine compressor. The impact of these delays was an unrecoverable 3 months delay.
- Key subcontractors are behind schedule due to outer missile mold line changes made by Lockheed Martin. These design changes resulted from anomalies discovered during a JASSM jettison test from an F-16.
- Changes to the outer missile mold line also drove changes to the pitot static/air data system. As a result, two additional DT flights are now required to calibrate the air data system.

The approved LFT&E strategy for JASSM does not include any dedicated live fire test activity. Instead, the information needed to support the eventual Live Fire lethality evaluation will be derived from contractor-conducted tests and from combined DT/OT and IOT&E attacks of representative targets by missiles equipped with live warheads.

## **TEST & EVALUATION ACTIVITY**

DOT&E, AFOTEC, OPTEVFOR, the program office, and the contractor formulated a mutually acceptable strategy that: (1) incorporates early OT involvement; (2) makes early and continued use of modeling and simulation to gain T&E efficiencies; (3) takes advantage of planned developmental test activity to reduce the operational test matrix; and (4) incorporates operational units into OT&E strategy to minimize the time required to train these operational units following fielding of the JASSM system.

DOT&E and the service OTAs have been especially active in defining the scope of the overall combined test strategy and assessing the program for opportunities to accelerate OT&E and LFT&E through integrated DT/OT events, where prudent. The JASSM Program Director and the service test agencies have supported this effort. A key facet of the Program Director's test strategy is that there will be no government-directed developmental T&E of the system. The contractor is responsible for the planning and execution of the DT phase of the program. While the government has a test support role (test aircraft, government ranges, test instrumentation, etc.), the overall developmental test responsibility resides with the prime contractor. This program supports combined developmental and operational test demands, and eventually leads into independent government IOT&E. This high level of early OT&E interaction with the developer is in response to the joint program office's desire to maximize OT participation in the combined phases in an effort to satisfy OT&E objectives as early as possible.

During FY99, two flight tests of JASSM PDRR were conducted. During the first launch (FTV-1), a hardware fault was sustained that led to a mission failure. The second flight test (FTV-2) repeated the objectives of the initial flight and met all pre-planned objectives. A successful jettison test program was also conducted during 1999. Captive seeker characterization activity using a flying testbed (helicopter carrying JASSM sensor/seeker components) is ongoing.

The principal Live Fire-related activity in FY99 was warhead qualification testing, which included two sled tests, two arena tests, and insensitive munitions testing. The sled tests addressed penetration of a concrete target at high obliquity and subsequent fuze functioning. In the two arena tests, the warheads were detonated statically in a horizontal position to gather blast and fragmentation data to support model validation and Joint Munitions Effectiveness Manual effectiveness estimates. The insensitive munitions tests included various fast and slow cook-offs, fragmentary/bullet impact, and sympathetic detonation tests.

The program office funded the construction of high fidelity, full-scale bunkered test targets and obtained soft/soft-distributed targets, which will be attacked during DT/OT and IOT&E flights with live warheads. The targets are located at White Sands Missile Range and Tonopah Test Range.

## **TEST & EVALUATION ASSESSMENT**

There are four areas of concern: (1) Teledyne T-407 engine problems; (2) the validation of the required modeling tools for OT&E; (3) the ability of the system to meet its requirement to be carrier/shipboard operable; and (4) the adequacy of the number of test missiles.

*First*, the T-407 engine is being redesigned to incorporate a fuel lubricated bearing. The benefits of this change are expected to be extended storage life, the recycling of fuel, and possible increases to the missile's range. Additionally, a digital control unit is replacing the analog fuel control system. These changes are expected to induce schedule delays and may require additional scrutiny during tests.

*Second*, the Modular Effectiveness Vulnerability Assessment (MEVA) model, currently under development and validation/verification, is a critical tool in the evaluation of the weapon. MEVA is the model that will be used to assess the effects of the JASSM warhead penetration in hard targets. The ability of the model to accurately predict weapon effects is undemonstrated in two major areas: multiple hits on the same target and target materials characterization. Regarding the first, the model does not have the capability to characterize the target state after the first missile hit, rendering predictions of subsequent hits insoluble. In the second, target materials characterization, performed by the 46<sup>th</sup> Test Wing, has not been validated by the Defense Intelligence Agency. Curious results have been seen in model test runs (e.g., missile speeds up in concrete). On account of the extensive use of modeling proposed in the test program and the lack of demonstrated capabilities addressed above, MEVA validation and verification must be of the highest priority with the program office and the operational test community.

*Third*, the carrier operability concerns encompass areas such as electromagnetic compatibility, catapult and arrestment robustness, and container size. The joint program office has developed a definitive set of evaluation criteria to address issues related to carrier operability. There is not a requirement for JASSM integration on the F/A-18E/F aircraft to satisfy this key performance parameter.

*Fourth*, operational testing of missile effectiveness is predicated on the requirement that the missiles will be fired at targets until each target is damaged or destroyed to the required level (often stated as, "shoot until it dies"). DOT&E perceives that the number of allocated missiles is minimally adequate to meet the missile effectiveness measure if the observed failure rate is very small. Steps have been taken to prevent additional risks to the program in the eventuality that the failure rate is not near zero, and the effectiveness measure therefore remains unresolved. The program office has assured DOT&E that additional missile assets will be made available, if required, to ensure that the missile effectiveness measure can be properly evaluated.

Unexpected missile behavior during a jettison test resulted in changes to the missile's structural configuration. This new configuration requires additional evaluation of missile aerodynamics and air data system probe placement, to be completed in FY00. DOT&E will closely monitor these flight tests and the remaining November 1999 PDRR prototype flight test to gain early insight into JASSM performance.

From a lethality perspective, the sled testing conducted thus far indicates that the warhead remains intact when impacting reinforced concrete targets, and with some exceptions to be corrected, the fuze can survive and function properly. The arena tests results indicated that the JASSM warhead achieves the expected blast and fragmentation effects. Due to some unfavorable cook-off tests results, the aft closure of the warhead was redesigned and re-tested. Additional testing is required to verify that the fuze functions properly at all possible delay times.

## **CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED**

JASSM is an acquisition reform program with no government-directed developmental testing. The program progresses directly from contractor testing to OT&E. This acquisition reform initiative presented several challenges for the JASSM program. The program's accelerated pace mandated early involvement on the part of the operational test community. Our early involvement in the program, during the request for proposal stage, was essential in laying the foundation for data collection during the later portions of the contractor-led DT test phase. The joint program office has created an environment that fosters this early interaction.

The construction of realistic targets for DT and OT launches of missiles supplied with live warheads should provide a clear indication of JASSM's lethality against its expected target classes.

